



**Russian Federation**  
**The Republic of Moldova**  
**CLIMATE CHANGE AND AGRICULTURE**  
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This Country Note for Moldova is part of a series of country briefs that summarize information relevant to climate change and agriculture for four pilot countries in the Europe and Central Asia (ECA) Region, with a particular focus on climate and crop projections, adaptation options, policy development and institutional involvement. The Note series has been developed to provide a baseline of knowledge on climate change and agriculture for the pilot countries participating in the **Regional Program on Reducing Vulnerability to Climate Change in ECA Agricultural Systems**. This note for Moldova was shared with the Government and other agricultural sector stakeholders and used as an engagement tool for a National Awareness Raising and Consultation Workshop, held in Chisinau in October 2009. Feedback and comments on the Note from this consultation process have been incorporated into this updated version in collaboration with the Ministry of Agriculture and Food Industry (MAFI).

#### Climate Change Exposure and Risk for Moldova

Agriculture is extremely important for rural livelihoods in Moldova, with more than 41% of the population employed in the sector and 11% of the country's GDP derived from agriculture. Agriculture is also a highly climate sensitive sector, and as such, much of Moldova's rural population and livelihoods are vulnerable to climate change. Historical data indicate that Moldova is exposed to a highly variable climate that has already experienced an increase in mean temperature, moisture deficits and extreme events, like droughts, floods and frosts. Climate projections for the future indicate that Moldova likely will be exposed to:

- A 3.4°C increase in mean annual temperature for the 2040-69 period, with the greatest warming projected to occur in autumn and winter
- A decline in mean annual rainfall by 6.8% for the 2040-69 period and a decline in mean rainfall for summer and autumn by 19.3% and 16%, respectively
- An increase in the frequency and severity of drought, with the probability of catastrophic drought (less than 50% of mean rainfall) increasing from one event in nine years to almost one event in two years
- A more marginal and risky agricultural production environment, as increases in temperatures and reduced precipitation during critical crop and pasture growth periods will cause a moisture deficit, significantly shifting the country to a dry sub-humid or semi-arid climate.
- An increased exposure to new pests and diseases for agricultural crops, forests and livestock due to temperature increases

#### In this Note

I. Introduction .....	2
II. Agriculture .....	2
III. Agriculture and the Adaption Deficit .....	3
IV. Agriculture and the Economy .....	3
V. Agriculture and the Environment .....	4
VI. The Climate Context .....	5
VII. Impact of Climate Change on Agriculture and Water Resources .....	7
VIII. Potential Adaption Measures for the Agriculture Sector .....	10
IX. Impacts of Agriculture on Greenhouse Gas Emissions .....	11
X. The Policy Context .....	12
XI. The Institutional Context .....	13
XII. Ways Forward .....	15

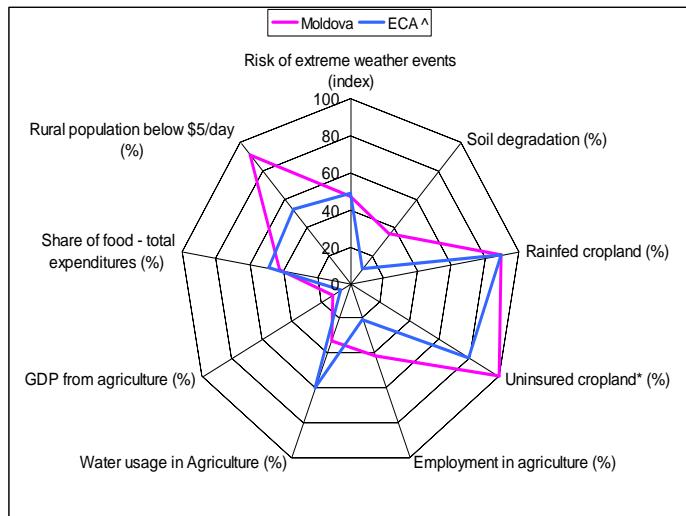
#### **Moldova at a Glance<sup>3</sup>**

<b>Population</b>	3,603,506 (2009 est.)
<b>Population below the poverty line</b>	28.7%
<b>GDP</b>	US \$5.4 billion (2009)
<b>GDP Per Capita</b>	US \$1,516 (2009)
<b>Agriculture as a % of GDP</b>	11%

## I. Introduction

The Europe and Central Asia (ECA) Region of the World Bank recently released a new report titled “*Managing Uncertainty: Adapting to Climate Change in Europe and Central Asia.*”<sup>1</sup> The report is a flagship document that raises awareness of the threats, challenges and opportunities that ECA countries and communities will face in adapting to climate change across a variety of economic sectors. This Country Note was developed as a basis for beginning work in Moldova under a World Bank regional program to enhance the ability of ECA countries to integrate climate change adaptation into agricultural policies, programs, and investments.<sup>2</sup>

**Figure 1: Moldovan Vulnerability Indicators**



Note: ^ECA statistics come from transitioning and developing economies in Eastern Europe and Central Asia, where available; employment in agriculture (% of total employment); rain-fed cropping (% of cropland); water usage in agriculture (% of total annual freshwater extraction); uninsured cropland (estimate); soil degradation (% of total land); risk of extreme weather events (additional 1:20 year events 2070-2100 vs. 1961-1990); share of food – % of total expenditures; GDP from Agriculture; Sources: World Development Indicators 2008; EarthTrends 2003, FAO AGL 2005; Baettig, M. et al., 2007. ECA Databank

Agriculture is of vital importance to Moldova, in terms of employment, rural livelihoods, food security, rural growth and exports. Because this sector is highly climate sensitive, existing inequalities between rich and poor populations and vulnerable communities within Moldova may be exacerbated as a result of climate change, placing a further strain on institutions, food supply and rural growth. Moldova’s limited financial position and institutional capacity to respond to natural climatic hazards also pose a threat to future sustainable agricultural production and rural development.

**Figure 1** displays nine climate change vulnerability indicators and compares Moldova to the Europe and Central Asia (ECA) Region average for transition economies. For a number of indicators, agriculture and rural livelihoods in Moldova appear to be equal to or less vulnerable than the ECA average to climate change. However, three categories where Moldova appears significantly more vulnerable than other countries in the region are for soil degradation, the percentage of the population employed in the agricultural sector and the percentage of the rural population living on less than \$5 dollars per day. When compared to high income European countries (for categories where figures are available), the differences in vulnerability to climate change are stark, with European countries having an average of just 4.5% of the population employed in agriculture as opposed 41.4% in Moldova, while the average GDP derived from agriculture for high income European countries in Europe is just 2%, compared to 11% in Moldova.<sup>3</sup>

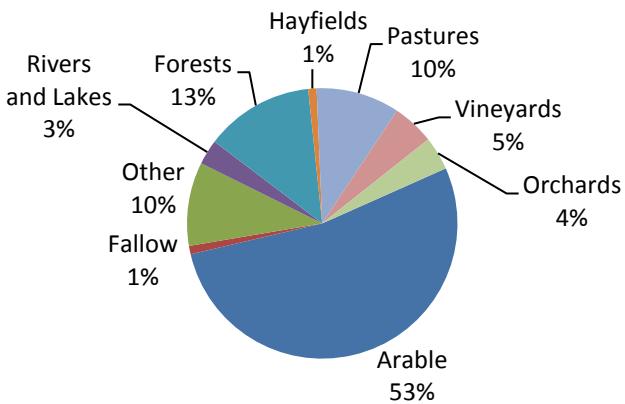
## II. Overview of Agriculture

Agriculture is the dominant land use in Moldova (**Figure 2**). By far the most significant land use is arable land for annual crop production. Much of this arable land sits on highly fertile and productive black chernozem soils, which cover 75% of the country, especially the northern districts and the Dniester River Valley. High quality soil resources, along with various microclimates, support a wide array of annual and perennial crop production across the country. By area, the major annual crops grown are maize, wheat, sunflowers and barley. Vineyards and fruit trees are the main perennial crops. As nearly 90% of this production is rain-fed, there can be significant changes in the crop mix and area planted on a year-to-year basis, depending on the timing and quantity of rainfall and associated extreme events, like drought.<sup>3</sup>

### Acknowledgements:

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**Figure 2: Land Use in Moldova**



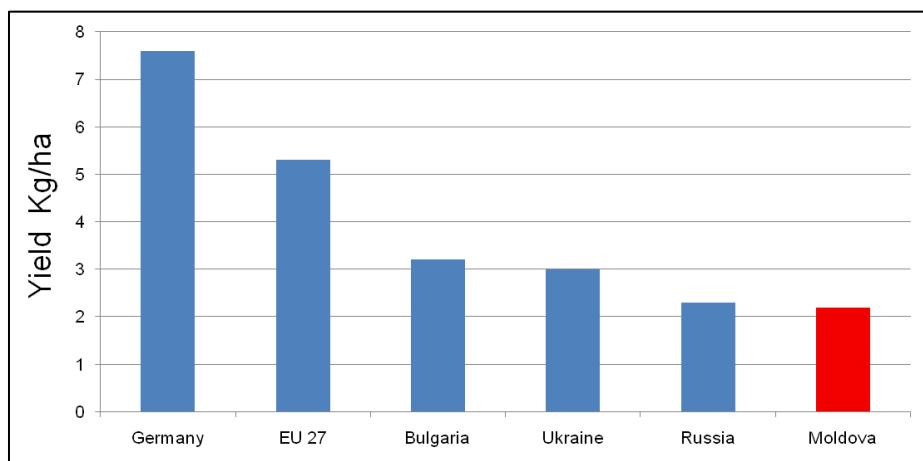
Source: National Bureau of Statistics, 2009. Statistical Yearbook of the Republic of Moldova, Chisinau.

Projected changes in climate - including increased temperatures, decreased precipitation and an increase in the number of extreme events - pose a serious risk to agricultural production, water availability, food self-sufficiency and security and economic growth, particularly for rural livelihoods in Moldova. Across the country there will be a significant variation in vulnerability to climate change, depending on current climatic exposure, economic strength, social structures, institutional capacity, knowledge and education and access to infrastructure. Areas that are already under marginal rain-fed production will be at increasing risk. Communities in relatively high rainfall or irrigated areas will have more adaptation options to buffer their production systems against projected changes in climate. In some instances, if appropriate measures are put in place, there may be potential opportunities for increased production in Moldova as a result of climate change.

### III. Agriculture and the Adaptation Deficit

With the majority of the rural population both poor and dependent on the agricultural sector for their livelihood, rural communities are particularly vulnerable and at risk from changes that may occur as a result of climate change.<sup>3</sup> Risks posed by climate change are further exacerbated by Moldova's relatively low productivity, resulting from a lack of adaptive capacity to the present climate - also known as the adaptation deficit. This is best illustrated by a comparison of wheat yields from other countries in the region, as displayed in **Figure 3**. For example, a look at the country's average wheat yield from 2007-09 reveals that Moldova's average yield was 68.7% of Bulgaria's yield and just 41.5% of the EU-27 countries during that period. This underperformance can be attributed to a complex set of factors, including distortions and imperfections in agricultural output and input markets; poor quality public services in areas like agricultural education, extension, research, and market information systems; a bias in public support programs against family farmers; delays in farm restructuring and undeveloped agricultural land markets; lack of access to finance; unsustainable management of soils; insufficient irrigation; and high vulnerability to natural hazards like droughts, floods, frosts, and severe storms.<sup>1,7</sup> The challenges created by this unfavorable environment for agriculture will increase significantly as a result of climate change, making action necessary to address the adaptation deficit as part of any climate change adaptation strategy.

**Figure 3: Comparative Average Wheat Yields 2007-09**



Source: Adapted from <http://faostat.fao.org>

### IV. Agriculture and the Economy

The economy of Moldova has gone through a tremendous transition since the break-up of the USSR in the early 1990's. Severe economic and social dislocation occurred during this period, resulting in a major contraction of the economy. This economic contraction was further compounded by severe drought and other natural disasters in 1994.<sup>14</sup> Starting in 2000,

Moldova began experiencing an economic upswing and experienced an average GDP growth rate of 5.4% between 2002 and 2007<sup>3</sup>, while GDP per capita rose to US\$ 1,516 in 2009.<sup>3</sup>

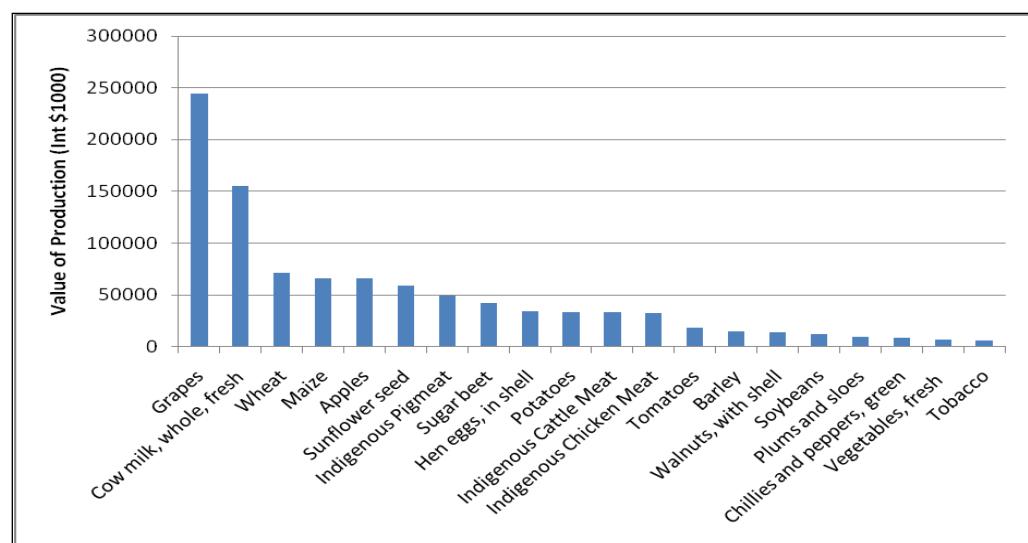
Agriculture has traditionally been a major component of the Moldovan economy, especially during the transition to independence. However, the impact of this transition and the associated breakdown of collective and state farms had a negative consequence for growth in the agricultural sector. This has meant that the share of the agricultural sector in GDP has declined from 33% to 11% between 1995 and 2009, and now trails GDP contributions from the service, industrial and manufacturing sectors.<sup>3</sup> However, when the agricultural sector is combined with the agro-processing sector, the importance of agriculture to the Moldovan economy becomes more fully illustrated, with the combined sectors accounting for approximately 30% of GDP, 60% of exports and 50% of industrial output.<sup>3</sup> Furthermore, the agricultural sector provided 41.4% of total employment from 2003-2005.<sup>3</sup> These figures highlight the inherent vulnerability of the national economy to climate related events that impact the agricultural sector. This level of vulnerability is further compounded at a livelihoods scale, as 90.8% of the rural population earns less than \$5 per day and is highly vulnerable to any changes in agricultural income.<sup>3</sup>

The value of agricultural production in the national economy for 2008 was US\$ 1.5 billion.<sup>9</sup> Plant production contributed 67.6% to the overall value, while animal production and animal services contributed 30.3% and 2.1%, respectively.

Between 2005-08 the overall value of agricultural production increased by 29.3% with both the plant production and animal production sectors growing significantly by 31.3% and 29.1%, respectively.<sup>12</sup>

At the commodity level, grapes, whole fresh cow milk, wheat, maize and apples made the most significant contributions to the average value of agricultural production in Moldova from 2005-07 (**Figure 4**). Although field crops like wheat, maize and sunflower are grown extensively and occupy a large percentage of the cropping land (**Figure 3**), their contribution by value is significantly less than the combined contribution made by grapes and apples, which garner a higher price.<sup>10</sup>

**Figure 4: Average Value of Agriculture Production 2005-07**



Source: Adapted from <http://faostat.fao.org>

## V. Agriculture and the Environment

Agri-environmental management has implications for both greenhouse gas emissions and the resilience of agriculture to climate change in Moldova. The most significant impacts agriculture in Moldova has on the environment are associated with soil degradation and water pollution from agrochemicals and poor nutrient management practices, which contribute to eutrophication of local water catchments.<sup>10</sup> Both of these issues adversely affect the natural resource base of the country and increase the vulnerability of agricultural systems and rural livelihoods to external shocks, like climate change. Further, poor tillage and nutrient management practices contribute not only to surface and ground water pollution, but also to greenhouse gas emissions from the agricultural sector.

Agricultural impacts on water resources are also a significant environmental issue in Moldova. Poor fertilizer management and agrochemical storage practices, as well as inadequate manure management, have resulted in polluted water catchments and contaminated groundwater resources across the country. Non-agricultural factors have also contributed to this problem, including unregulated waste disposal by industry and inadequate infrastructure and management of sewage from human settlements. The contamination of surface and groundwater resources has serious implications for both the environment and human health. Eutrophication of catchments adversely affects aquatic ecosystems and associated food

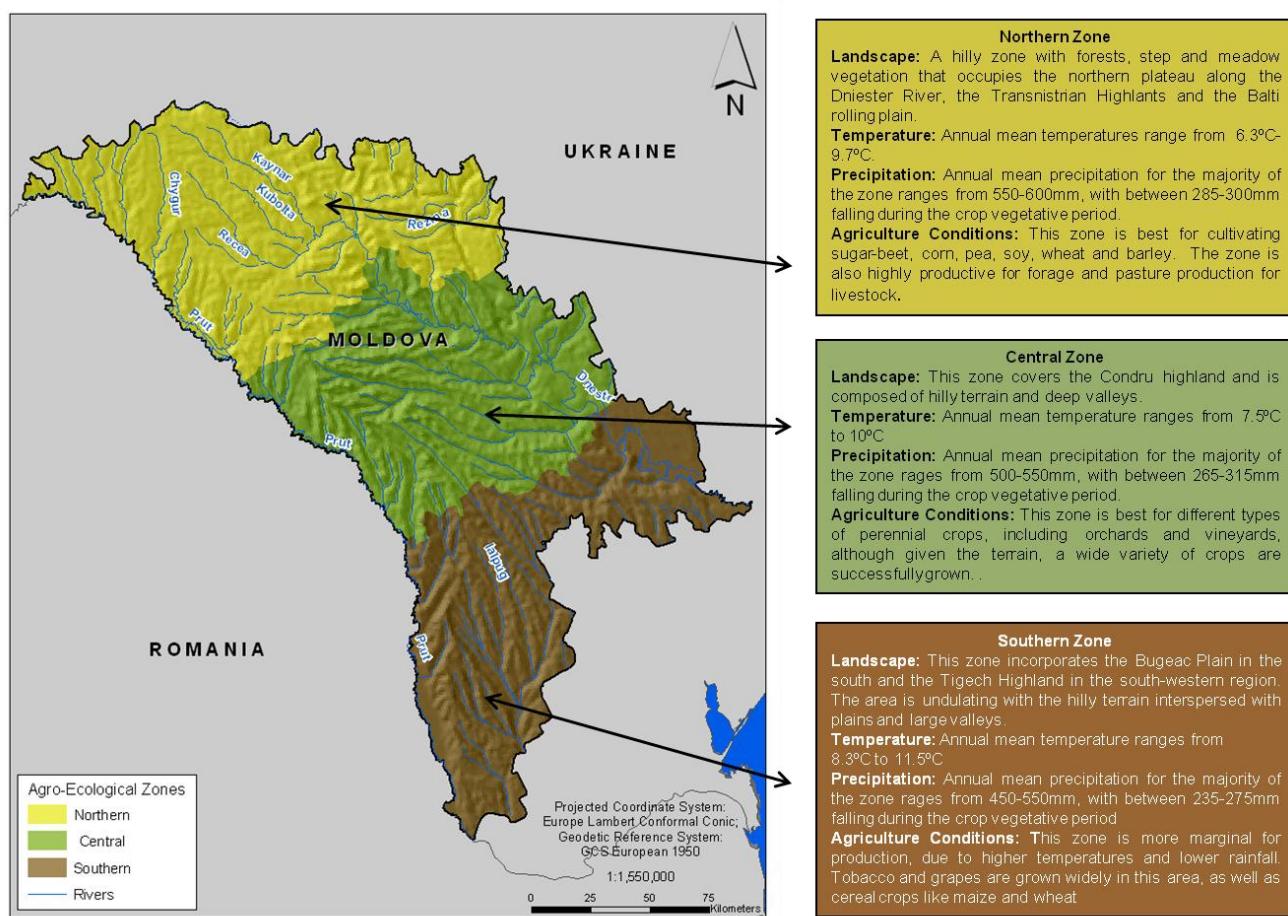
chains and more than half of the population of Moldova gets their drinking water from groundwater sources. The Ministry of Health and Social Protection indicated that 76% of monitored groundwater sites did not meet hygiene standards in 2006.<sup>10</sup> This situation could be exacerbated by the effects of climate change, thus highlighting the importance of integrating environmental considerations into the agricultural sector to improve rural livelihood outcomes.

## VI. The Climate Context

### Climate Description and Historical Trends

Moldova has a temperate continental climate formed mainly by the Atlantic air mass from the west and the Mediterranean air mass from the southwest. It is characterized by short mild winters, long warm summers and a high level of variability across the country. This highly variable climate creates a challenging environment for the agricultural sector, particularly for farmers of rain-fed annual crops. The nearby Black Sea and the topographic relief are also important influences on the microclimate, which determines the specialization in agriculture across the country to a significant degree.<sup>10</sup> Annual mean temperature in Moldova ranges from 8°C in northern Moldova to 10°C in south-eastern districts. Precipitation generally increases from the south-east of the country to the north-west, with annual precipitation ranging from less than 500mm to more than 625mm respectively. Although the wettest months of the year typically occur in the first half of the summer, lengthy dry spells, especially in late summer, combined with high temperatures and hot continental winds can severely stress crops and pastures during critical stages in their growth cycle.<sup>14</sup>

**Figure 5: Agro Ecological Zones of Moldova**



Source:  
 1) Agro-Ecological Zones adapted from Daradur M., Cazac V., Mihailescu C., Boian I. Climate monitoring and droughts. Ministerul Ecologiei și Rezursei Naturale. Serviciul Hidrometeorologic de stat. Chișinău, 2007; Hazardous risks management in the Republic of Moldova. National Agency for rural development. Chișinău, 2007  
 2) DIVA GIS

Moldova can be divided into three major agro-ecological zones based on temperature and precipitation (see **Figure 5**). The three agro-ecological zones are the Northern, Central, and Southern zones, which are also known as the Northern forest-steppe, the Central forest zone and the Southern steppe, respectively. Each of these zones will be impacted by climate change differently due to significant differences in topography, temperature, humidity and precipitation, as well as variations in production systems.

## Historical Climate Trends



Throughout its history, Moldova and its people have been exposed to a variety of extreme climate events that have affected all aspects of life, especially agriculture. These extreme events include droughts, rain storms, hail, frost and floods. The most devastating event for the agricultural sector is drought. The climate of Moldova has always been highly variable, with droughts regularly recorded.

The State Hydrometeorological Service of Moldova (SHS) reports that northern Moldova experiences a drought once every ten years on average, central Moldova once every five to six years, and southern Moldova once every three to four years. However, in the last two decades droughts have been registered more frequently and have generally been more severe. Moldova registered nine drought years between 1990-2007, causing significant yield declines in crops and pastures. Drought occurred

only in summer during six of those nine years, but in 1990, 1992 and 2003 the droughts lasted the whole vegetative period (April-September).<sup>19</sup> In 2007, Moldova experienced its most severe drought in living memory, with 80% of the country's territory impacted by the event, including widespread crop failures and food shortages.<sup>11,12</sup> This change in drought frequency has recently been assessed by scientists from the National Hydrometeorological Center, who concluded that, based on records from 1834-2000, the probability of *catastrophic droughts* (less than 50% of mean rainfall) has increased significantly, from one event every nine years to almost one event every two years.<sup>15</sup>

A recent World Bank report on rural productivity in Moldova attempted to make some estimates on the annual cost of extreme weather events on agriculture in the country. Although this analysis was undertaken prior to the record drought event of 2007, annualized losses from drought were still estimated at US \$20 million per/year, based on a catastrophic event occurring once every seven years.<sup>19</sup> Losses in the agricultural sector from other extreme events like severe weather and floods were estimated to cause approximately US \$7.5 million and US \$5 million in damage, respectively.<sup>11</sup> Given the change in frequency and severity of drought in recent times, these figures appear to be an underestimation. The impact of the drought in 2000 on agriculture was estimated to have caused losses of US \$170 million.<sup>18</sup> Although this figure is significant, the severe drought of 2007 dwarfs this, with losses for the agricultural sector estimated at close to US \$1 billion.<sup>12</sup> The greatest losses were experienced by fruit and vegetable growers (US \$550 million), livestock producers (US \$305 million) and cereal growers (US \$132 million). These recent trends in drought and associated impacts on the agricultural sector highlight the importance of taking immediate and proactive action to minimize economic and agronomic losses from such events in the future.

## Climate Projections

There are a number of different local studies on projections for future climate change in Moldova. Although these studies differ somewhat, the general trends across most climate models and emission scenarios indicate that the country will become hotter and drier, with wetter winters, drier summers and more variable precipitation. The latest analysis undertaken by national scientists in Moldova indicates that the country is projected to become significantly warmer, with a mild reduction in annual precipitation.<sup>11</sup> Analysis was performed using six general circulation models (GCM's), the A2 high emissions scenario and three time horizons, with the

**Table 1: Future Climate Projections for Moldova, Compared to the 1961-90 Baseline Period**

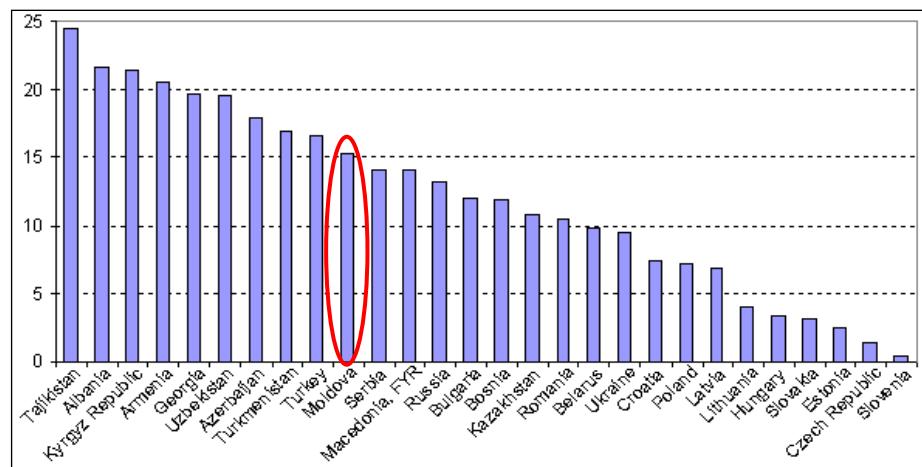
Time Horizon	A2 Temperature Projections		A2 Precipitation Projections	
	Ensemble Average °C	Ensemble Range °C	Ensemble Average (mm)	Ensemble Range (mm)
2010-2039	1.7	1.3 – 2.4	-9	-31 – 23
2040-2069	3.4	2.4 – 5.8	-38	-104 – 1
2070-2099	5.4	3.4 – 9.5	-64	-189 – 18

Source: Adapted from Expert Grup, Centru Analitic Independent, 2009. Draft Report: 2009 National Human Development Report, Socio-Economic Impact of Climate Change in Moldova and Policy Options to Adapt (Forthcoming).

results displayed in **Table 1**. The ensemble average projects that the mean temperature for Moldova will increase by 1.7°C and 3.4°C for the 2010-39 and 2040-69 time horizons, respectively. For the same time horizons, precipitation is projected to decline by 9mm and 38mm, respectively. On a seasonal basis, the greatest warming from a percentage basis is projected to occur in winter and autumn, with winter temperatures projected to increase by 4.0°C for the 2040-69 time horizon. For the same time period, winter and spring precipitation are projected to increase slightly, while summer and autumn precipitation are projected to decrease by 19.3% and 16%, respectively. Given that the summer months are presently the wettest of the year, this has significant implications for the agricultural sector.

The recent World Bank report “Adapting to Climate Change in Europe and Central Asia” developed a series of indices to assess the exposure, sensitivity and adaptive capacity of countries to climate change in the ECA Region. The indices are based on a range of relevant parameters. The vulnerability index displayed in **Figure 7** is a combination of the exposure, sensitivity and adaptive capacity indices. The vulnerability of Moldova to climate change based on this index can be classified as medium-high compared to other countries in the region. The main underlying drivers of vulnerability identified were the limited adaptive capacity and particular social and productive structures, which enhance the sensitivity of Moldova to climate change.

**Figure 7: Climate Change Vulnerability Index, ECA Region**



Source: The World Bank, 2009 Adapting to Climate change in Europe and Central Asia, Washington DC

## VII. Impacts of Climate Change on Agriculture and Water Resources

### Agricultural Risks and Opportunities



Although potential benefits for the agricultural sector may result from climate change, the downside risks for Moldova outweigh any of these benefits.<sup>11</sup> Moldova is not well positioned to exploit these opportunities, even for particular crops and agro-ecological zones that could benefit from climate change, as any potential benefits pale in comparison to the existing costs of Moldova's relative inefficiency and low productivity in the agricultural sector.<sup>12</sup> Evidence of this can be demonstrated by the significant yield gap between Moldova and its neighbors (**Figure 3**), which highlights the present adaptation deficit of the agricultural sector to the current climate, let alone a highly variable and challenging future climate.

Climate change projections combine with adverse agricultural implications to frame the challenge for Moldova. Although mean annual rainfall is only projected to decline moderately, the climate is expected to become more arid

and risky for agricultural production, due to increasing temperatures and longer dry periods. With increased temperatures and drought risk, the threat to crop yields is clear, especially for summer crops. Furthermore, changing climatic conditions may lead to problems associated with an array of agronomic issues, including changes in soil drainage patterns leading to salinity, erosion and exposure to new pests and diseases that challenge existing plant and animal genetics and management. However, across Moldova the length of the growing period will increase, as the number of frost days is projected to greatly reduce. This reduction in frost days will provide opportunities for crop distribution changes and longer-season varieties, if Moldova can move to exploit them.

### Potential Impacts on the Livestock Sector

Changes in temperature, precipitation and water scarcity will affect not only cropping conditions, but also the livestock sector in terms of animal health, nutrition, husbandry and livestock-related infrastructure. Changing climatic conditions will

adversely affect fodder and forage production and pasture biomass, which could lead to volatile feed prices, increased competition for grazing lands and increased water scarcity. Furthermore, because much of Moldova's methane emissions result from enteric fermentation within farm animals, many potential climate adaptation options and policies will include the livestock sector. At present, livestock production in Moldova is meeting less than 50% of domestic demand.<sup>21</sup> As a result, the total number of livestock is projected to increase by 63% by 2050,<sup>21</sup> threatening to drastically increase methane emissions from this sector.

In response to these projections, the Second National Communication outlines potential adaptation options for the livestock sector in Moldova, including<sup>12</sup>:

- Gradual replacement of breeds of livestock with higher productivity breeds
- Quality improvement of the forage supply reserve by reducing forage consumption in the livestock breeding sector
- Use of sustainable manure management systems
- Maintaining and improving the genetic pool of breeding animals
- Upgrading small and medium animal breeding farms in rural areas

### **Projected Crop Yield Impacts**

Yield projections developed by the International Institute for Applied Systems Analysis (IIASA) for rain-fed maize and wheat yields for 2025 and 2050 are displayed in **Figure 8**. The projections clearly display the spatial variability of yield impacts across the country and the difference between crops for both time periods. For wheat, the majority of the country is projected to experience a moderate decline in yields of between 0-10% for 2025.

By 2050, however, severe yield declines of up to 25% are projected for the central and southern parts of Moldova, while more moderate yield declines of up to 10% are projected for northern areas. The impact on rain-fed maize production is projected to be more severe, with yield declines of up to 25% projected for the central part of the country by 2025, and almost all of Moldova by 2050.

In the First National Communication, modeling was also undertaken to assess the impact of climate change on grape production and quality in Moldova, with the results presented in **Table 2**. They indicate that with no adaptation, productivity will decline by a range of 13-19% and 22-30% by 2010-39 and 2040-69, respectively.<sup>19</sup> However, the higher temperatures may improve grape quality, via increased sugar content, which could substantially boost wine quality.<sup>19</sup> Furthermore, the analysis suggests that the area cultivated with grapes could extend to the northern border of the country.<sup>19</sup>

The overall adverse impact of climate change on agricultural productivity for a variety of crops highlights the need to develop agricultural systems that are resilient and highly adaptable to a future of more arid and variable conditions. Considerable work and investment will also be required in areas of opportunity - like table grapes - to take advantage of such opportunities.<sup>1</sup>

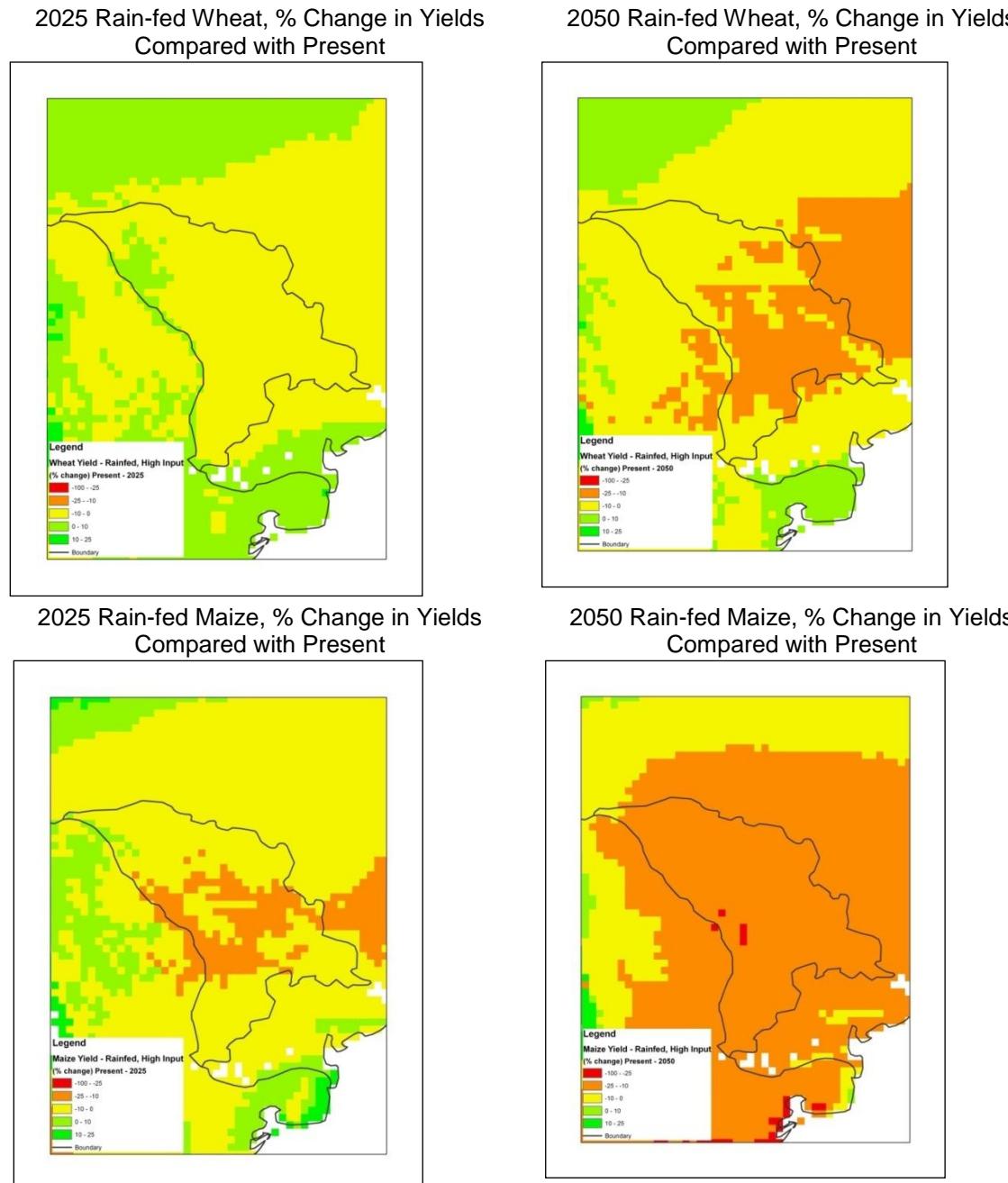
**Table 2: Projected Change in Grape Productivity and Quality for 2010-2039 and 2040-2069 Compared to the 1961-1990 Baseline Period<sup>1</sup>**

Time Horizons	1961-1990	2010-2039	2040-2069
<b>Productivity (kg/bush)</b>	5.74	4.81	4.3
<b>Sugar Content (gr/cm<sup>3</sup>)</b>	15.51	16.16	16.44

Source: Adapted from Ministry of Environment and Territorial Development, 2000. First National Communication of the Republic of Moldova under the United Nations Framework Convention on Climate Change, Chisinau.

<sup>1</sup> Grape productivity and sugar content projections are based on the ensemble average of three GCMs; CSIRO Mk2, HadCM2 and ECHAM4

**Figure 8: Projected Change for Wheat and Maize Yields for 2025 and 2050 Compared to the 1961-90 Baseline Period**



Source: World Bank Climate Change Knowledge Portal <http://sdwebx.worldbank.org/climateportal/> and Fischer, G., et.al. 2007. Global Agro-ecological Zone Assessment for Agriculture. IIASA, Luxemburg, Austria & FAO, Rome, Italy

### Projected Water Resources Impacts

Projections of climate change impacts on the water resources of Moldova were featured in a recent World Bank study. These projections have been modeled for the annual water basin yield using the wettest and driest GCMs for the ECA region as a whole.

The water basin yield combines both annual runoff and reservoir storage to quantify surface water availability.<sup>13</sup> The projections for Moldova in 2050 indicate that eastern and central districts will experience a significant decline in the annual water basin yield of greater than 15% for the driest GCM. The basin yield in other areas will be mildly affected with yields

expected to increase or decrease by less than 5%. However, the seasonal timing of water flow events and the increase in frequency of extreme events, either floods or drought, will reduce the reliability of water flow in all the catchments across the country.

Over the past decade a number of studies have also been undertaken by scientists in Moldova. The results of these analyses have varied widely, from substantial increases to significant declines in water resources. The most recent projections are more pessimistic than those outlined in the World Bank study and indicate that the two major catchments of the country (Dniester and Prut) will experience significant declines in available surface water resources, as displayed in

**Table 3.** Significant shifts in water demand and increased competition for water are likely to occur across all sectors of Moldova – including agriculture - in the coming decades. Irrigated land and associated water demand have diminished significantly since 1990 (excluding Transnistria) declining from 193,000 ha in 1990 to approximately 24,000 ha in 2005.<sup>10</sup> This drop in the irrigated area of Moldova is due to several factors, including aging pumping stations, deteriorating and broken down equipment, higher energy costs making water pumping unaffordable for private farmers, the collapse of the agricultural sector during the 1990's and the restructuring of farm land which resulted in the existing irrigation system not conforming with new farm plot sizes.<sup>7</sup> As these factors are addressed and rectified it is highly likely that demand for water in the irrigated sector will increase substantially, especially given the consequences of projected climate change on rain-fed agriculture.

**Table 3: Projected Changes in the Availability of Surface Water for the Dniester and Prut River Catchments, Compared to the 1961-90 Baseline Period**

Time Horizon	Change in Surface Water Availability
2020's	-15.9%
2050's	-36.0%
2080's	-57.7%

Source: Adapted from Expert Grup, Centru Analitic Independent, 2009. Draft Report: 2009 National Human Development Report, Socio-Economic Impact of Climate Change in Moldova and Policy Options to Adapt

## **VIII. Potential Adaptation Measures for the Agricultural Sector**

Moldova's First and Second National Communications, as well as other documents, propose a range of adaptation options for the agricultural and water resources sector.<sup>19,21</sup> A number of the adaptation options discussed are presently ready for implementation and are technologies proven to increase current productivity – a “win-win” situation. Unfortunately, many of these options have not been implemented because of constraints associated with a variety of economic and social factors. With low levels of productivity, a highly variable climate and a high reliance on rain-fed agriculture, Moldova has significant food sustainability and food security risks. With growing global demand and increased agricultural vulnerability under climate change, food security and food sustainability risks could increase substantially. Poor rural communities are particularly exposed to this risk, as they have limited purchasing power in global food markets.

Since it is likely that the downside risks to the agricultural sector from climate change outweigh potential benefits, the focus for interested stakeholders should be placed on reducing the adaptation deficit by increasing the efficiency, productivity and adaptive capacity of agriculture to the present climate, while simultaneously developing effective medium and long-term adaptation options for the dominant farming and livestock systems across the three agro-ecological zones of Moldova.

The uncertainties of climatic developments dictate that these adaptation options should be evaluated robustly under a range of different future climate scenarios. As finances are limited, it is also imperative that adaptation options which offer the greatest return on investment from an economic, social and environmental perspective be prioritized and implemented to improve the resilience of agricultural systems and rural livelihoods. It is important that adaptation options are developed not only at the national scale, but at the agro-ecological zone scale, so that they specifically address the climate change challenges that local communities face. This will ensure that human and economic capital is directed towards the development and implementation of adaptation strategies that are relevant, targeted and effective.

Although there are many field-ready innovations that could improve the resilience of agricultural systems in Moldova, the lack of financial resources at the farm level is a considerable barrier to utilizing these innovations. Additionally, significant investments will be required by the state and development partners to build the infrastructure, knowledge and policy systems that can support and develop an array of adaptation options to increase the resilience of the farm sector into the future.

A list of adaptation options for agriculture and water resources recommended in a number of Moldovan publications are displayed in **Table 4**. This is by no means an exhaustive list of options, but provides a starting point from which further options can be developed.

**Table 4: Adaptation Options for the Agricultural and Water Sectors of Moldova**

Sector	Adaptation Option
<b>General</b>	Invest in research and extension services to enhance the capacity and delivery of information to the agricultural sector, with particular reference to climate change and the implementation of adaptation options.
	Improve the early warning and weather information systems, including the publication and distribution of agriculture-specific weather forecasts on a frequent basis (e.g. short-term and seasonal forecasts, the monitoring of drought, etc.)
	Invest in the monitoring and detection of new pests and diseases for the crop, livestock and forestry sectors through improvements in the sanitary and photosanitary regime.
<b>Rain-fed Cropping</b>	Development of new genetic varieties with higher resilience to increased temperatures and lower precipitation, with the potential of increased production via carbon fertilization.
	Increase farming system water-use efficiency and reduce soil erosion via improved surface management techniques, including the adoption of minimum and zero tillage practices.
	Development and adoption of improved agronomy and risk management techniques
	Improved plant protection, through enhanced monitoring of pests and diseases and improved education of farmers via extension services.
<b>Irrigation</b>	Rehabilitation of economically viable irrigation and delivery schemes to improve access and system water-use efficiency.
	Developing water recycling schemes that use treated waters from communal waste water treatment plants.
	Modernization of on-farm distribution systems.
	Introduction of new irrigation techniques and improvement of existing techniques to enhance field level water use efficiency.
	Small scale irrigation development and creation and rehabilitation of local water storage and associated infrastructure
<b>Livestock</b>	The adoption of better adapted animal breeds and grass/legume seed stock that are better adapted for projected hotter and drier conditions.
	Improved farmhouse micro-climate management through the use of thermal insulating construction materials and modern ventilation systems to protect livestock from extreme conditions and increase productivity.
	Improved pasture management by matching stocking rates to pasture production and integrating pasture improvement to increase feed value.

Source: Adapted from UNFCCC. Republic of Moldova First National Communication (<http://unfccc.int/resource/docs/natc/moldnc2.pdf>); Shabanova G, Izverscaia T (2004) Sensitivity of Moldova's natural plant communities to climate change. In: Corobov (ed.) Moldova's climate in XXI century. Chisinau, Elan Poligraf, 99–151; Lalikin N., Serenco L., Samotiev S. and Solodkii A. The climatic changes of Moldova's water resources in XXI century and adaptation to them. Page. 34-37; Corobov R, Cealic S, Buiucl P (2004) Assessment of crop production sensitivity to likely climate change. In: Moldova's Climate in 21 century. Chisinau, 2005, (in Russian); Scorpan V. Impacts of high temperatures on vegetation systems due to climate change. Climate Change: Research, studies and solutions. Ministry of Environment and Territorial Development, UNDP. Chisinau, 2000, (in Romanian and Russian); Expert Grup, Centru Analitic Independent, 2009. Draft Report: 2009 National Human Development Report, Socio-Economic Impact of Climate Change in Moldova and Policy Options to Adapt (Forthcoming)

## **IX. Impacts of Agriculture on Greenhouse Gas Emissions**



Globally, agriculture contributes 14% of total greenhouse gas emissions. When combined with land use change and forestry, these sectors contribute 32.7% of total emissions, which is second only to the energy sector.<sup>13</sup> Moldova has recently compiled a second National Greenhouse Gas Inventory that uses the period from 1990-2005 as a reference period. The inventory includes emissions from a range of sectors including energy, industrial processes, agriculture, land-use change and forestry and waste. As a result of significant economic contraction and structural changes to the economy after 1990, net greenhouse gas (GHG) emissions for Moldova declined by 72.3%<sup>13</sup> from 1990-2005. As of 2005, the agricultural sector accounted for 17.9% of Moldova's GHG emissions (28% higher than the global average). This emission level was second only to the energy sector, which produced the majority of GHG for the

country (65%).<sup>19</sup> The land-use change and forestry sector remained a net sink of GHG through the 1990-2005 period, primarily as a result of reforestation, improved forest management practices and reduced rates of illegal logging.<sup>19</sup> The existence of significant mitigation potential in the agricultural sector is evidenced by the fact that in 2005 the equivalent of 12% of total emissions for Moldova was mitigated by this sector.<sup>7</sup>

### Agriculture and Land-Use Change

Agriculture accounts for 29.9% and 90% of Moldova's methane and nitrous oxide emissions, respectively.<sup>19</sup> The major source of methane emissions from the agricultural sector results from enteric fermentation of farm animals, with minor levels of emissions resulting from manure management and the burning of agricultural residues.<sup>19</sup> Nitrous oxide emissions from the agricultural sector are predominantly a result of the application of nitric fertilizers and associated soil fertility management, although poor land and manure management practices also contribute.<sup>19</sup>

To mitigate agricultural emissions, the Second Communication of Moldova outlines action plans until 2020 for both the agriculture and the land use change and forestry sectors. The strategies outlined in the respective action plans are:<sup>24</sup>

- ◆ Optimization of land resources
- ◆ Rehabilitation of irrigation systems
- ◆ implementation of a program to combat erosion and cultivation of low-productive lands
- ◆ Maintenance of improvement of breeding animals genetic pool
- ◆ incentivizing equipment and re-equipment of small and medium farms
- ◆ Recovery of Methane through improvements in livestock manure management, including biogas capture for energy

## X. The Policy Context

The Second National Communication of Moldova is the primary policy document that assesses the potential impacts of climate change and outlines adaptation options to respond to projected future climate hazards. The document includes climate projections for Moldova to 2100 and undertakes a preliminary vulnerability assessment of sectors including agriculture, water resources and forestry. This assessment includes an analysis of climate change impacts using three separate GCM's and time periods, as well as broad recommendations and potential adaptation and mitigation options for each sector. To assess the economics of mitigation and adaptation actions, the report also includes cost benefit analysis; however, no evaluation or prioritization of the adaptation options was performed.

### National Plans, Strategies, Programs, and Analytical Studies

Currently Moldova does not have a focused climate change and adaptation policy document. The mainstreaming of climate change into the policy initiatives of the agricultural sector is still relatively new. Mainstreaming, however, is a key component to help ensure that investments and decision making for the agricultural sector and rural development are based on potential climate conditions and not historical conditions. Given the multi-sectoral nature of the issue, climate change has been addressed, to a minor extent, in several policy documents, briefly described below.

**The National Development Strategy (NDS) 2008-2011.** Adopted in December 2007, this document formulates Moldova's key strategic objective "*to ensure a better quality of people's lives by strengthening the foundation for a robust, sustainable and inclusive economic growth*". The NDS explicitly recognizes that the incidence of poverty is higher in rural than areas in urban areas and that this is due to low agricultural productivity and limited non-agricultural employment opportunities. In terms of climate change, the document doesn't specify anything directly, but rather emphasizes issues related to agriculture, including soil conservation, scaling-up of afforestation on degraded farming lands and upgrading the national monitoring system for hydrometeorological conditions.

**The Agricultural and Food Sector Development Strategy 2006-15.** This document outlines a significant strategic step to prioritize the development of the organic agricultural sector by doubling organic production and tripling certified farmed areas by 2015.<sup>7</sup> The strategy aims to integrate domestic legislation and practices for organic farming and products with EU requirements and to support the development of the organic sector through research, development and extension.<sup>7</sup> The strategy is already having an impact and a rapid increase of the area of certified organic production has occurred over recent years. The major organic products are vegetables, wines, dried fruits and walnuts.<sup>7</sup> To achieve the objectives of the

strategy, it is clear that climate change and adaptation are key components that should be analyzed, integrated and mainstreamed.

**National Strategy of Natural Hazards Mitigation and Climate Change (NSNHC).** This is one of the first strategy documents aimed at mainstreaming climate change into the national policy setting. The main objectives of the NSNHC are to: 1) increase the level of adaptation of natural resources, ecosystems and agriculture to climate change; 2) maintain low levels of greenhouse gas emissions; 3) consolidate the institutions involved in management and alleviation of extreme events; and 4) raise institutional and community awareness concerning natural risks and climate change. In order to accomplish the strategic vision, the NSNHC focuses on: (i) the development of infrastructure for disaster mitigation; (ii) the development and implementation of insurance instruments against natural disasters; (iii) the implementation of adaptation measures for anticipation and mitigation of natural disasters risks; and (iv) the strengthening of the institutional and legal framework for coordination of activities between national and international organizations in responding to natural hazards.

### **Other Analytical Studies Related to Climate Change in Moldova**

A number of studies and reports have been written on a wide range of subjects associated with analyzing the impact of climate change and fostering capacity to deal with the issue. Some of the most important studies include:

- **UNDP & The Expert Group: 2009 National Human Development Report, Socio-Economic Impact of Climate Change in Moldova and Policy Options to Adapt.** This report undertakes a comprehensive assessment of climate change vulnerabilities, impacts and adaptation measures at the sectoral level for Moldova. Sectors analyzed in this work include agriculture, water resources, energy, transport, human health and natural systems. Existing policies, laws and regulatory systems are assessed in relation to their effects on climate-induced vulnerabilities for a number of sectors including agriculture, forestry, disaster management and water.
- **World Bank: Rural Productivity in Moldova – Managing Natural Vulnerability, 2007.** This study outlines the key opportunities and considerations for the mitigation of natural hazards, especially for the highly exposed and vulnerable agricultural sector. An analysis of the occurrence, impact and potential mitigation options for a range of natural hazards affecting Moldova is undertaken within this report, with a focus on reducing risk through natural hazard mitigation or by addressing vulnerability<sup>16</sup>. Within the report, climate change is not analyzed as a separate threat but is broadly incorporated within a number of key threats.
- **Ministry of Ecology and Natural Resources and State Hydro-Meteorological Service: Climate Monitoring and Droughts, 2007.** This comprehensive study covers both theoretical and practical aspects of climate and drought monitoring. It is based on the latest country-level climate data, including historic observations from local meteorological stations going back over 150 years. The study also includes detailed analysis of the impacts of projected future changes in climate on agricultural systems in the country, including the impact of extreme events.
- **Ministry of Environment and Territorial Development & UNDP: Climate Change: Research, Studies and Solutions, 2000.** This a collection of articles related to the various aspects of climate change research, modeling and information support. The publication has a series of articles devoted to assessing climate change vulnerability and outlining potential adaptation strategies for natural systems, soil resources, water resources, agro-ecosystems and livestock.

## **XI. The Institutional Context**

The institutional arrangements in Moldova, with regard to climate change and adaptation, have significant room for improvement. Given the complexity and multi-disciplinary nature of climate change, a number of institutions are each focused on different aspects of this issue and its associated challenges. However, in order to address climate change in an efficient and systematic way, there is a need for formal structures for coordinating across relevant ministries that will ensure a better overview of climate change policy. The Ministry of Finance would also be an important stakeholder in creating and overseeing such a structure, given its critical position in terms of resource allocation.

**The Ministry of Environment (MOE)** is the national environmental authority and is also the Designated National Authority (DNA) on climate change and the Clean Development Mechanism (CDM) to the UNFCCC for Moldova. MOE is responsible for the development and promotion of policies, strategies and action plans for environmental protection, management and use of natural resources and waste management. MOE is also responsible for a number of other institutions that fall under

its jurisdiction, including the State Hydro-Meteorological Service (SMSS), the Agency for Geological Exploration, "Apele Moldovei" and the National Ecological Institute. In relation to agriculture and climate change the SMSS is an important organization and is responsible for weather forecasting and climate projections, as well as being the UNFCCC National Focal Point. The meteorological department operates and maintains the country's system of posts and weather stations. The department also issues public forecasts, including those concerning hazardous meteorological and hydrological events. Management of Moldova's water resources is also an important function of MOE via "Apele Moldovei". This institution has a variety of responsibilities, including the development of irrigation and water management policy and maintenance of major irrigation infrastructure (drainage pumping facilities, irrigation delivery channels, reservoirs, etc...) across Moldova.

**The Ministry of Agriculture and Food Industry (MAFI)** is responsible for the formulation and promotion of policies and strategies related to the development of the rural sector and food industry. Given the level of rural poverty, MAFI has an important role in improving rural livelihoods through increasing farm competitiveness and access to markets, while simultaneously reducing barriers for private investment in the sector. MAFI has departments relating to the regulation, administration, technical support and oversight of agricultural production and processing throughout the country. MAFI also provides research, development, extension, education and training services through a range of organizations, including the Soil Institute, the Animal Breeding and Veterinary Medicine Institute, the State Agrarian University and the Institute for Field Crops. This last institute focuses on a number of activities, including crop breeding, seed multiplication, farming systems research, organic agriculture development and farm modernization.<sup>7,25</sup>

**Forestry Agency "Moldsilva"** is a state institution responsible for forestry policy development and the management of state forestry resources. This includes the establishment of new forests, management and protection of existing forests, research and monitoring of forest ecosystems and the rehabilitation of degraded and eroded agricultural lands via afforestation programs.

**The Agency for Consultancy and Training in Agriculture (ACSA)** has an important role as the lead agency for agricultural extension services in Moldova. Throughout the country the ACSA employs more than 350 consultants to deliver farmer advisory services via direct consultations, seminars and trainings on an array of agricultural and production system topics.<sup>7</sup>

**Farm Associations and Industry Groups** are primarily responsible for representing the interests of different sectors of the agricultural community. A number of these organizations have been recipients of capacity building efforts and resources from donor-funded projects and are important channels for the dissemination of information and the collection of data at the producer level. These organizations include the National Farmers Federation, National Federation AgroInform, the UniAgroProject network of 15 regional Agricultural Producers Associations and local Water User Organizations.<sup>7</sup>

## XII. Ways Forward

### This Country Note is just the First Step: Upcoming Activities in the Development of the Moldovan Response to Climate Change and Agriculture



National Awareness Raising and Consultation Workshop, Chisinau

In October 2009 an Awareness Raising and Consultation workshop on Reducing Vulnerability to Climate Change in Moldovan Agricultural Systems was held in Chisinau, Moldova. During this event, the Climate Change and Agriculture Country Note was disseminated to agricultural sector stakeholders and helped generate a groundswell of support and interest for further analytical work to reduce the vulnerability of the agricultural sector to climate change. A leading figure in this support has been the Moldovan Minister of Agriculture and Food Industry. The Minister expressed his appreciation for the Country Note (which was prepared in collaboration with the World Bank) and indicated the importance of addressing climate change in Moldovan agricultural systems for both the current climate and projected future climate. The Minister acknowledged the impact climate change is having on Moldovan agriculture via adverse trends in temperature, precipitation and the frequency and severity of droughts. These thoughts were echoed by workshop participants and other

stakeholders, including the Hydrometeorological Institute, Moldova State Agrarian Institute, Field Crops Research Institute "Selectia", Institute of Orchards and Vineyards, and farmers. The Minister also expressed his strong commitment and interest in enhancing the Government's ability to mainstream climate adaptation into agricultural policies, programs and investments by building on the initial steps already undertaken by the Moldovan government and associated institutions. Towards this goal, he agreed that MAFI would fully support, and work jointly with, the World Bank to develop the Moldovan Response to Climate Change for Agriculture program.

Broadly, this work involves rigorous analysis and economic modeling to assess both the impacts of climate change and potential adaptation measures for a range of farming, livestock and production systems. The analysis is currently being performed by expert staff from the international consulting firm Industrial Economics, Inc. (IEc), in close consultation with local experts across a range of organizations, under the direction of the World Bank. IEc is also delivering training and capacity building services to local experts and organizing sub-national consultation meetings with farmers, policymakers and researchers to raise awareness of the risks and opportunities posed by climate change on the agricultural sector. This work will culminate in the development of an Agriculture and Climate Change Impact Assessment & Menu of Adaptation Options that will highlight the physical, economic and social impacts of climate change on the agricultural sector and identify adaptation priorities for investments, capacity development and policy improvement. These options will be practical and operational, with a focus on "win-win-win" options that have benefits for adaptation, mitigation and the local economy. This analysis will be discussed at a high-level National Dissemination and Consensus Building Conference to be jointly hosted by MAFI and the World Bank in March 2011. The conference will help build consensus on the way forward by identifying practical priorities for action. A Regional Knowledge Exchange Conference will follow, wherein Moldovan experts can share their experiences and results while simultaneously learning from experts from other countries in the Europe and Central Asian Region. This forum will also explore opportunities for greater regional collaboration and assist with the establishment of regional communities of practice for experts working on agriculture and climate change issues.

**The Sustainable Development Department of the ECA Region at the World Bank is carrying out a regional, three-year program of analytical and advisory activities to better determine the potential impacts of climate change on the agricultural sector in four pilot countries: Albania, FYR Macedonia, Moldova and Uzbekistan. Through the Regional Program on Reducing Vulnerability to Climate Change in ECA Agricultural Systems, the World Bank is working with stakeholders to develop practical recommendations on actions these countries can take to increase the resiliency of their agricultural sectors to the impacts of climate change. The overall objective of the program is to enhance the ability of ECA countries to mainstream climate adaptation into agricultural policies, programs and investments. This will be achieved by raising awareness of the threat, analyzing potential impacts and adaptation responses and building capacity among country stakeholders with respect to climate change impact assessment and adaptation in the agricultural sector.**

## References

- <sup>1</sup> "Managing Uncertainty: Adapting to Climate Change in ECA Countries", 2009, The Europe and Central Asia Region, The World Bank
- <sup>2</sup> The concept of the Country Notes is derived from the series of Country Notes developed for the LAC Region by S. Edmeades and W. Janssen et al., 2009, The World Bank
- <sup>3</sup> World Development Indicators, 2009, The World Bank
- <sup>4</sup> The World Bank, 2008, Moldova Second Poverty Reduction Support Credit, Program Document, Report No. 43251-MD
- <sup>5</sup> The World Bank, 2005, Moldova Opportunities for Accelerated Growth, Country Economic Memorandum, Report No. 32876-MD
- <sup>6</sup> [http://www.nationmaster.com/time.php?stat=eco\\_gdp\\_rea\\_gro\\_rat-economy-gdp-real-growth-rate&country=md-moldova](http://www.nationmaster.com/time.php?stat=eco_gdp_rea_gro_rat-economy-gdp-real-growth-rate&country=md-moldova)
- <sup>7</sup> Sutton, W. et al. 2008. Integrating Environment into Agriculture and Forestry: Progress and Prospects in Eastern Europe and Central Asia. The World Bank, Washington DC
- <sup>8</sup> The World Bank, 2009. ECA Databank. Washington DC
- <sup>9</sup> National Bureau of Statistics, 2009. Moldova in Figures – Statistical Pocket-Book, the Republic of Moldova, Chisinau
- <sup>10</sup> <http://faostat.fao.org>
- <sup>11</sup> The World Bank, 1995. Agriculture Sector Review - Moldova, Washington DC
- <sup>12</sup> Prepelita N. 2007 drought in the Republic of Moldova. Regional scientific and technical conference on the role of the NMHSs in prevention and mitigation of natural hazards impact impact, 9-10 October 2008, Chisinau, Republic of Moldova (see: <http://www.un.org/esa/sustdev/sdissues/desertification/beijing2008/presentations/prepelita.pdf>)
- <sup>13</sup> <http://earthobservatory.nasa.gov/NaturalHazards/view.php?id=19186>
- <sup>14</sup> <http://europeandcis.undp.org/hiv aids/show/5FA036E5-F203-1EE9-B83D3C39323CE910>
- <sup>15</sup> The World Bank, 2007. Rural Productivity in Moldova – Managing Natural Vulnerability. Washington, DC
- <sup>16</sup> Expert Group, Center Analytic Independent, 2009. Draft Report: 2009 National Human Development Report, Socio-Economic Impact of Climate Change in Moldova and Policy Options to Adapt.
- <sup>17</sup> Iglesias, A. et al., 2007, Adaptation to Climate Change in the Agricultural Sector, AEA Energy & Environment, Didcot
- <sup>18</sup> The World Bank, 2009. Adapting to Climate Change in Europe and Central Asia, Washington DC
- <sup>19</sup> Ministry of Environment and Territorial Development, 2009. Second National Communication of the Republic of Moldova Under the United Nations Framework Convention on Climate Change, Chisinau
- <sup>20</sup> Ministry of Environment and Territorial Development, 2000. First National Communication of the Republic of Moldova Under the United Nations Framework Convention on Climate Change, Chisinau
- <sup>21</sup> World Bank, 2009. Water and Climate Change: Understanding the Risks and Making Climate-Smart Investment Decisions, Washington DC.
- <sup>22</sup> <http://cait.wri.org/cait.php?page=sectors&url=form&pOpts=open&pHints=shut&year=2000&co2=1&ch4=1&n2o=1&pfc=1&hfc=1&sf6=1&lucf=1&update=Update&c1=115&c2=185&c3=501&c4=527&c5=500&c6=&c7=&c8=>
- <sup>23</sup> Ministry of Environment and Natural Resources & UNEP, 2009. National Inventory Report 1990-2005: Greenhouse Gas Sources and Sinks in the Republic of Moldova, Chisinau.
- <sup>24</sup> [http://www.utm.md/master/en/parteneri/m\\_ecol.html](http://www.utm.md/master/en/parteneri/m_ecol.html)
- <sup>25</sup> [http://www.increast.eu/\\_media/Questionnaire\\_Host\\_Institutions\\_EECA\\_Moldova\\_RIFC\\_Selectia.pdf](http://www.increast.eu/_media/Questionnaire_Host_Institutions_EECA_Moldova_RIFC_Selectia.pdf)

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